

Based on a photograph, courtesy of Ray T. Matheny, Brigham Young University



Based on a photograph taken in 1948 before the site was disturbed, drawing depicts canals, reservoirs, a civic center, and a moated fortress of the Maya Indians at Edzná, Campeche, Mexico. The letters indicate: (a) a civic/ceremonial center; (b) canal; (c) water reservoirs; (d) canal; and (e) moated fortress. The canals and reservoirs are dated about 150 BC. Light-colored patches represent agricultural plots of current inhabitants.

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Richard E. Leakey reported a well-preserved skull from East Africa that is "almost identical" to the well-known Peking remains from China but is more than twice as old. Donald C. Johanson of Case Western Reserve University reported a new series of fossil remains in Ethiopia, including some hand bones and other materials that appear to be at least three million years old. (See Feature Article: ANTIQUITY OF MAN IN AFRICA.) Yale University anthropologist David Pilbeam reported significant new fossil evidence from Pakistan that sheds light on prehuman primate ancestors of eight million to ten million years ago. This possible ancestor of the genus *Homo*, labeled *Ramapithecus*, had been known only from a series of jaw fragments and teeth. Pilbeam's discoveries include, for the first time, parts of arms and thighbones as well as another complete lower jaw. (See Year in Review: ARCHAEOLOGY.)

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The chief significance of this find relates to the study of 40,000 distinctive stone building blocks, known as Talatat, that have been found over the past 100 years in various excavations at Karnak. Since 1966 the Ikhnaton Temple Project, utilizing a computer, individual photographs of the blocks, and a staff of young Egyptian archaeologists, has been matching up these stones into entire chains of scenes showing Ikhnaton and Nefertiti, his consort, paying tribute to the sun-god Aton. Some eight temples are represented by the Talatat, but no meaningful structures could be delineated. The foundations of Gem-Pa-Aton provide a ground plan on which to rebuild part of the temple complex.

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Another unique feature was the presence of two stone statues embedded in the altar with lead about the feet. The one intact figure, 11 cm tall, probably represents Apollo and is one of the best examples of Archaic Greek art. Among the many offerings were a painted clay cock, a clay mask probably representing Artemis, and many bronze rings. There was also a Phocaeen silver coin dating from 457–446 bc.

**China.** A New China News Agency article on paleoanthropological research in China during the past 25 years contained references to numerous recent discoveries, including an "apeman" who lived 1.7 million years ago, about one million years earlier than the famous Peking Man of Chou-k'ou-tien. Reinterpreting past and recent finds of the "Upper Cave Man" (first discovered in a cave above that containing Peking Man) near Chou-k'ou-tien, the Chinese archaeologists concluded that he lived about 500,000 years ago, was a proto-Mongoloid type, and may be ancestral to the Chinese, American Indian, and Eskimo people. They pointed out that since few human fossils were found in China until recently, Western researchers erroneously assumed a gap of hundreds of thousands of years between Peking Man and Upper Cave Man and generally rejected a line of descent between Peking Man and modern man.

Relating to the historic period, a recent report disclosed the discovery of some 1,000 bamboo slips inscribed with the earliest known Chinese laws. They were found in one of 12 tombs in Yün-meng county in central China that were discovered by peasants digging a drainage ditch. Dating from the Ch'in dynasty (221–206 bc), they include laws, acts concerning farmland, judicial cases, a book on the "ways of officials," and specific cases showing how court trials were conducted.

**Thailand.** Pisit Charoenwongsa, co-director of the Thai Department of Fine Arts/University Museum (University of Pennsylvania) excavations in northeast Thailand, was preparing a paper giving a new time perspective to prehistoric archaeology in Southeast Asia, based on his work with Chester Gorman of the University Museum at the site of Ban Chiang. Until recently Southeast Asia had been seen by archaeologists as a "cul-de-sac," a "cultural backwater" where innovation took place only after Indian and Chinese cultural penetration in fairly recent times. However, following the discovery of early agriculture, pottery manufacture, and metal manufacture in the area, there has been a growing awareness of the probability that an innovative, indigenous, and very early bronze age originated there.

Materials excavated at Ban Chiang in 1974 and 1975, still in the process of study, represent seven time phases at the site, dating from the mid-4th millennium bc to the early 2nd millennium ad (based on a series of 18 carbon-14 dates and an equal number of thermoluminescence dates). Cast tin-bronze objects are found in the earliest level c. 3600 bc, and iron objects in the fourth level (1200–1600 bc). Evidence of domesticated rice and domesticated cattle and pigs also appears in the earliest level. Thus it might well turn out that

Southeast Asia was the center of development rather than a cul-de-sac. However, tin and copper deposits are known in southern China as well as in Thailand, Malaysia, and other regions in the area, and it remained uncertain whether bronze manufacture actually began in northeast Thailand.

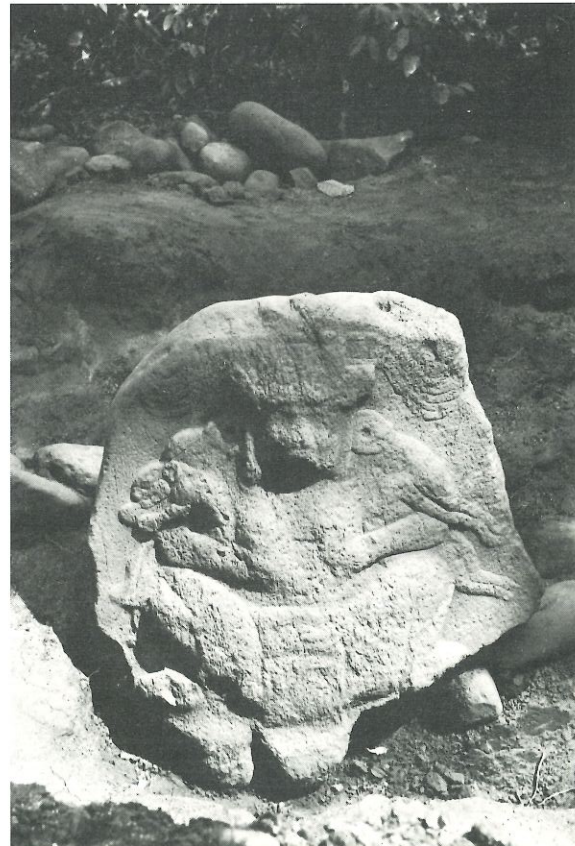
**Central America.** An excavation at a site called Abaj Takalik near Retalhuleu, Guatemala, conducted by John A. Graham and Robert F. Heizer of the University of California at Berkeley, was of particular interest because, for the first time, extensive Olmec and Maya carved monuments (stelae) were found at the same site. The Olmec civilization, centering on the Gulf Coast of Mexico, was probably the oldest true civilization in America and certainly preceded the Maya by some centuries, although Olmec and Maya inscriptions are clearly related. More than 50 stelae were found at the site, and several of them were produced by the Olmec people. One, of the Maya type, gives a date of June 3, AD 126—which is 166 years older than a stela at Tikal that was previously the oldest known in the Maya area. Further, this highland site, like that at Kaminaljuyú in Guatemala City, substantiates the

idea that Mayan civilization originated in the highlands rather than in the hot lowlands where the most famous sites are located.

**North America.** The age and the origin of the American Indians continued to be an unresolved argument among American archaeologists. For example, Paul S. Martin of the University of Arizona believed that technically skilled hunters first arrived in America via the Bering Strait about 12,000 years ago while Richard S. MacNeish claimed that small bands of unskilled hunters arrived, also via the Bering Strait, at least 40,000 years ago. The argument was intensified by a new dating process called racemization, developed by Jeffrey L. Bada, for dating bones. By means of this process, a human skeleton from a cliff near Del Mar in California was dated at 48,000 years old, and further dating led some to speculate that man may have been in America as long as 70,000 years ago.

One of the most expensive archaeological digs ever undertaken in America was directed to this basic controversy. The National Geographic Society and the U.S. National Park Service were investing \$600,000 in an area around Dry Creek,

*Carved monuments by the Maya (left) and Olmec (right) Indians were discovered in Guatemala. This was the first time that significant numbers of Mayan and Olmec monuments were found at the same site.*



Photos by John A. Graham, © National Geographic Society

75 mi S of Fairbanks, Alaska, where Charles Holmes discovered an ancient site in 1973. William R. Powers and Russel D. Guthrie of the University of Alaska planned to search a 4,000-sq mi area for sites like that at Dry Creek, now dated to 11,000 years ago. Dry Creek lies in a narrow corridor that was ice-free during the glacial period and could have been a migration route for man and animals.

The trend among archaeologists toward attempting to answer contemporary social and political questions was exemplified by recent comments by the excavators of the vast Cahokia mound complex in southern Illinois. They spoke of it as the New York City of AD 1000 and thought their study could provide urban America with hints for survival. The site was believed to represent an Indian population of up to 40,000 persons. There is evidence of a highly organized society with a class structure, and the Cahokians traded as far east as the Atlantic, as far south as the Gulf of Mexico, and as far north as Lake Superior. The archaeologists in charge, including Melvin L. Fowler, James Anderson, and Charles J. Bareis, speculated that this great urban settlement broke down from within, through disintegration, disease, or a change of climate.

**Techniques.** The Applied Science Center for Archaeology (MASCA) at the University Museum (University of Pennsylvania) continued work on the "correction factor" for radiocarbon dating, in collaboration with the Laboratory of Tree-Ring Research at the University of Arizona. Part of this work included a search for buried bristlecone pine logs in California's White Mountains. Some years ago it was discovered that the amount of carbon-14 in the atmosphere has not remained constant as originally assumed, and that early radiocarbon dates are younger than the actual dates. The surest way to check and correct carbon-14 dates is to analyze tree rings from very ancient bristlecone pines, whose growth records can be traced down to the present. A correction factor has been worked out for the period from 5390 BC to AD 1950, but to reach further back in time one must find older logs.

It is no mean task to find such logs, which are buried deep in broad alluvial fans washed out from canyons in the White Mountains. To this end, Henry N. Michael of MASCA was carrying out experiments with a new instrument known as a soil-penetrating radar, developed by the Stanford Research Institute. An improved system employs telemetry to transmit the sensed data to a nearby vehicle equipped with a computer and display unit. The vehicle also contains a position-location device which plots the location of the radar traverses. Detected anomalies can thus be superimposed on a map or aerial photograph.

—Froelich Rainey

## Architecture and civil engineering

**Skyscrapers.** In 1896, after designing the Wainwright Building in St. Louis, Mo., and the Guaranty Building in Buffalo, N.Y., Louis H. Sullivan wrote about the problems to be faced in the erection of tall office buildings. His article, "The Tall Office Building Artistically Considered," attacked the notion that office buildings be only "the joint product of the speculator, the engineer, the builder." Instead, Sullivan urged that architects face the fact that the tall office building was "a problem to be solved—a vital problem, pressing for a true solution."

Sullivan analyzed the design of the office building in terms of its structure, its rooms, its windows, its horizontal and vertical planning, and its relations with the street on the ground floor. He proposed a *form* that would, for the solution of the problem, be "a final, comprehensive formula." His works and his words were both brilliant. He demonstrated that the office building had three parts: first, the ground floor and lower floors, which give public access; second, the tiers of typical, general office lofts; and third, the attic or top floors with specific purposes and equipment. In Sullivan's words, "From this [analysis] results, naturally, spontaneously, unwittingly, a three-part division, not from any theory, symbol or fancied logic. And thus the design of the tall office building takes its place with all other architectural types."

Sullivan's three-part form appeared for a long time to be the conclusive solution, but recent work has seemed to reconsider, revise, or deny Sullivan's propositions. This new work is characterized by the following: (1) the exterior skin is entirely glass, minimizing the difference between window and wall; (2) the exterior surface consists of a metal grid of lines, from top to bottom, without any expression on the outside of the changing functions and uses inside; (3) the structural frame is completely covered by the exterior skin, and does not appear on the exterior as an element of the building; and (4) the towers are trapezoidal in mass and outline, like cut stones or prisms. Several recently built examples are described below.

The John Hancock Tower in Boston, Mass. (I. M. Pei & Partners, architects, engineers; James Ruderman, structural; Cosentini Associates, mechanical), is a 60-story office building located next to H. H. Richardson's Trinity Church (1877) and facing obliquely onto Copley Square. The floor plan and building mass are trapezoidal, angled sharply away from the square. The reflective glass facades give dramatic reflections of the surrounding buildings.

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**China.** A New China News Agency article on paleoanthropological research in China during the past 25 years contained references to numerous recent discoveries, including an "apeman" who lived 1.7 million years ago, about one million years earlier than the famous Peking Man of Chou-k'ou-tien. Reinterpreting past and recent finds of the "Upper Cave Man" (first discovered in a cave above that containing Peking Man) near Chou-k'ou-tien, the Chinese archaeologists concluded that he lived about 500,000 years ago, was a proto-Mongoloid type, and may be ancestral to the Chinese, American Indian, and Eskimo people. They pointed out that since few human fossils were found in China until recently, Western researchers erroneously assumed a gap of hundreds of thousands of years between Peking Man and Upper Cave Man and generally rejected a line of descent between Peking Man and modern man.

Relating to the historic period, a recent report disclosed the discovery of some 1,000 bamboo slips inscribed with the earliest known Chinese laws. They were found in one of 12 tombs in Yün-meng county in central China that were discovered by peasants digging a drainage ditch. Dating from the Ch'in dynasty (221–206 BC), they include laws, acts concerning farmland, judicial cases, a book on the "ways of officials," and specific cases showing how court trials were conducted.

**Thailand.** Pisit Charoenwongsa, co-director of the Thai Department of Fine Arts/University Museum (University of Pennsylvania) excavations in northeast Thailand, was preparing a paper giving a new time perspective to prehistoric archaeology in Southeast Asia, based on his work with Chester Gorman of the University Museum at the site of Ban Chiang. Until recently Southeast Asia had been seen by archaeologists as a "cul-de-sac," a "cultural backwater" where innovation took place only after Indian and Chinese cultural penetration in fairly recent times. However, following the discovery of early agriculture, pottery manufacture, and metal manufacture in the area, there has been a growing awareness of the probability that an innovative, indigenous, and very early bronze age originated there.

Materials excavated at Ban Chiang in 1974 and 1975, still in the process of study, represent seven time phases at the site, dating from the mid-4th millennium BC to the early 2nd millennium AD (based on a series of 18 carbon-14 dates and an equal number of thermoluminescence dates). Cast tin-bronze objects are found in the earliest level c. 3600 BC, and iron objects in the fourth level (1200–1600 BC). Evidence of domesticated rice and domesticated cattle and pigs also appears in the earliest level. Thus it might well turn out that

Southeast Asia was the center of development rather than a cul-de-sac. However, tin and copper deposits are known in southern China as well as in Thailand, Malaysia, and other regions in the area, and it remained uncertain whether bronze manufacture actually began in northeast Thailand.

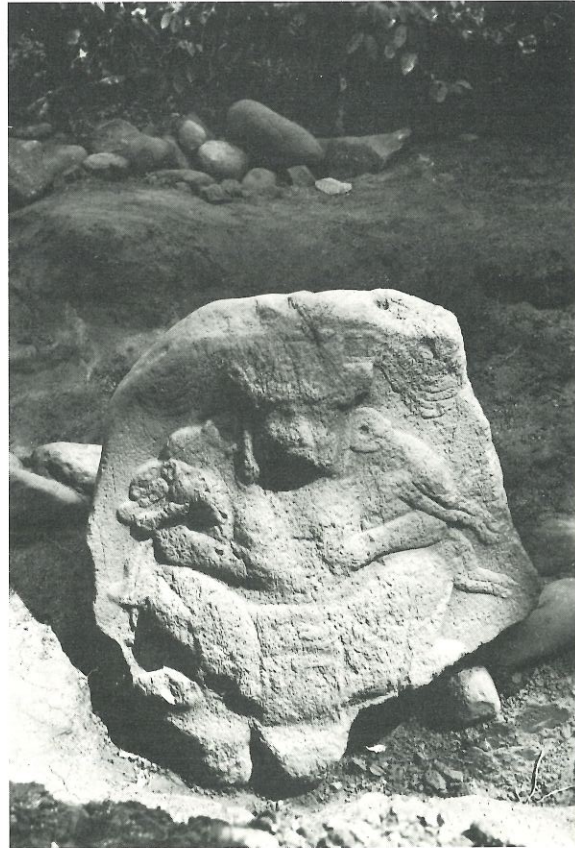
**Central America.** An excavation at a site called Abaj Takalik near Retalhuleu, Guatemala, conducted by John A. Graham and Robert F. Heizer of the University of California at Berkeley, was of particular interest because, for the first time, extensive Olmec and Maya carved monuments (stelae) were found at the same site. The Olmec civilization, centering on the Gulf Coast of Mexico, was probably the oldest true civilization in America and certainly preceded the Maya by some centuries, although Olmec and Maya inscriptions are clearly related. More than 50 stelae were found at the site, and several of them were produced by the Olmec people. One, of the Maya type, gives a date of June 3, AD 126—which is 166 years older than a stela at Tikal that was previously the oldest known in the Maya area. Further, this highland site, like that at Kaminaljuyú in Guatemala City, substantiates the

idea that Mayan civilization originated in the highlands rather than in the hot lowlands where the most famous sites are located.

**North America.** The age and the origin of the American Indians continued to be an unresolved argument among American archaeologists. For example, Paul S. Martin of the University of Arizona believed that technically skilled hunters first arrived in America via the Bering Strait about 12,000 years ago while Richard S. MacNeish claimed that small bands of unskilled hunters arrived, also via the Bering Strait, at least 40,000 years ago. The argument was intensified by a new dating process called racemization, developed by Jeffrey L. Bada, for dating bones. By means of this process, a human skeleton from a cliff near Del Mar in California was dated at 48,000 years old, and further dating led some to speculate that man may have been in America as long as 70,000 years ago.

One of the most expensive archaeological digs ever undertaken in America was directed to this basic controversy. The National Geographic Society and the U.S. National Park Service were investing \$600,000 in an area around Dry Creek,

*Carved monuments by the Maya (left) and Olmec (right) Indians were discovered in Guatemala. This was the first time that significant numbers of Mayan and Olmec monuments were found at the same site.*



Photos by John A. Graham, © National Geographic Society

75 mi S of Fairbanks, Alaska, where Charles Holmes discovered an ancient site in 1973. William R. Powers and Russel D. Guthrie of the University of Alaska planned to search a 4,000-sq mi area for sites like that at Dry Creek, now dated to 11,000 years ago. Dry Creek lies in a narrow corridor that was ice-free during the glacial period and could have been a migration route for man and animals.

The trend among archaeologists toward attempting to answer contemporary social and political questions was exemplified by recent comments by the excavators of the vast Cahokia mound complex in southern Illinois. They spoke of it as the New York City of AD 1000 and thought their study could provide urban America with hints for survival. The site was believed to represent an Indian population of up to 40,000 persons. There is evidence of a highly organized society with a class structure, and the Cahokians traded as far east as the Atlantic, as far south as the Gulf of Mexico, and as far north as Lake Superior. The archaeologists in charge, including Melvin L. Fowler, James Anderson, and Charles J. Bareis, speculated that this great urban settlement broke down from within, through disintegration, disease, or a change of climate.

**Techniques.** The Applied Science Center for Archaeology (MASCA) at the University Museum (University of Pennsylvania) continued work on the "correction factor" for radiocarbon dating, in collaboration with the Laboratory of Tree-Ring Research at the University of Arizona. Part of this work included a search for buried bristlecone pine logs in California's White Mountains. Some years ago it was discovered that the amount of carbon-14 in the atmosphere has not remained constant as originally assumed, and that early radiocarbon dates are younger than the actual dates. The surest way to check and correct carbon-14 dates is to analyze tree rings from very ancient bristlecone pines, whose growth records can be traced down to the present. A correction factor has been worked out for the period from 5390 BC to AD 1950, but to reach further back in time one must find older logs.

It is no mean task to find such logs, which are buried deep in broad alluvial fans washed out from canyons in the White Mountains. To this end, Henry N. Michael of MASCA was carrying out experiments with a new instrument known as a soil-penetrating radar, developed by the Stanford Research Institute. An improved system employs telemetry to transmit the sensed data to a nearby vehicle equipped with a computer and display unit. The vehicle also contains a position-location device which plots the location of the radar traverses. Detected anomalies can thus be superimposed on a map or aerial photograph.

—Froelich Rainey

## Architecture and civil engineering

**Skyscrapers.** In 1896, after designing the Wainwright Building in St. Louis, Mo., and the Guaranty Building in Buffalo, N.Y., Louis H. Sullivan wrote about the problems to be faced in the erection of tall office buildings. His article, "The Tall Office Building Artistically Considered," attacked the notion that office buildings be only "the joint product of the speculator, the engineer, the builder." Instead, Sullivan urged that architects face the fact that the tall office building was "a problem to be solved—a vital problem, pressing for a true solution."

Sullivan analyzed the design of the office building in terms of its structure, its rooms, its windows, its horizontal and vertical planning, and its relations with the street on the ground floor. He proposed a *form* that would, for the solution of the problem, be "a final, comprehensive formula." His works and his words were both brilliant. He demonstrated that the office building had three parts: first, the ground floor and lower floors, which give public access; second, the tiers of typical, general office lofts; and third, the attic or top floors with specific purposes and equipment. In Sullivan's words, "From this [analysis] results, naturally, spontaneously, unwittingly, a three-part division, not from any theory, symbol or fancied logic. And thus the design of the tall office building takes its place with all other architectural types."

Sullivan's three-part form appeared for a long time to be the conclusive solution, but recent work has seemed to reconsider, revise, or deny Sullivan's propositions. This new work is characterized by the following: (1) the exterior skin is entirely glass, minimizing the difference between window and wall; (2) the exterior surface consists of a metal grid of lines, from top to bottom, without any expression on the outside of the changing functions and uses inside; (3) the structural frame is completely covered by the exterior skin, and does not appear on the exterior as an element of the building; and (4) the towers are trapezoidal in mass and outline, like cut stones or prisms. Several recently built examples are described below.

The John Hancock Tower in Boston, Mass. (I. M. Pei & Partners, architects, engineers; James Ruderman, structural; Cosentini Associates, mechanical), is a 60-story office building located next to H. H. Richardson's Trinity Church (1877) and facing obliquely onto Copley Square. The floor plan and building mass are trapezoidal, angled sharply away from the square. The reflective glass facades give dramatic reflections of the surrounding buildings.